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Relationship heterogeneity in Taiwanese maritime logistics service supply chains

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Abstract

Purpose – With the diverse, heterogeneous nature of relationships being a key characteristic of service supply chains, their management is an important area for consideration. This is particularly true in the maritime logistics industry, yet the factors that lead to this heterogeneity are less well understood. This paper aims to explore the structure of relationships within the maritime logistics network and determine why they vary.

Design/methodology/approach - Interviews were carried out with 41 practitioners involved in the Taiwanese maritime logistics network. The data from these interviews were analysed using thematic analysis and quasi-quantification.

Findings - The interviews identify that structural holes exist within this maritime logistics network, and that these particularly influence the relationships within this sector with ports being significantly affected. However, five factors are particularly identified that can further impact the strength of these relationships. Often, weak links between ports and both cargo owners and freight forwarders emerge as value-added services are provided by the network.

Research limitations/implications - The findings are framed in a Taiwanese context, where cultural and political norms may give different results to other geographical regions. The research also limits consideration to containerized flows.

Practical implications - By providing detailed insights into relationship structures within the maritime logistics network, managers can take steps to develop appropriate links with other members of the network, reflecting upon the factors that lead to heterogeneity.

Originality/value - This paper expands knowledge on logistics service supply chains, identifying the importance of relationships in a derived demand environment. For maritime researchers, specific factors leading to relationship heterogeneity in the network are detailed, to inform future research.

Keywords - Maritime logistics, Relationship management, Network view, Heterogeneity, Service complexity.

Paper type - Research paper

1. Introduction

International maritime trade plays a significant role in the global economy with total volumes carried reaching 11 billion tons in 2018 and maritime logistics moving between 80 and 90 percent of all trade (UNCTAD, 2019). It is also an industry facing a period of change, including moderating global growth, supply chain restructuring, and the greater role of technology and services in value chains and logistics. Further supply-side trends include carriers seeking growth by both broadening services and becoming freight integrators as they respond to changes in trading conditions (UNCTAD, 2019).

Within this context, the proposition has been that the role of supply chains and the relationships between organizations in them is more important than the individual components of the overall supply chain (de Langen, 2004; Talley and Ng, 2013). This argument begins to address aspects such as through-transport where individual organizations act as components within broader systems rather than in isolation. Thus, cargo owners are not specifically interested in individual elements of the supply chain or network except where they provide a competitive advantage or cost reduction compared to alternative options (Beresford and Pettit, 2019). The emergence of such supply chains and networks is perhaps best illustrated by events such as the failure of Hanjin Shipping, where there were consequences for many organizations associated with maritime logistics (Rodrigue, 2016).

The consideration of this range of organizations is similar to taking a supply chain (or network) perspective, where the end product is the international movement of goods by sea. As Sampson and Spring (2012) and Selviaridis and Norrman (2014) both note, logistics services can be considered as a form of service supply chain. These have emerged as a distinct element of the broader supply chain management field over the past two decades. Much has been done to identify the key characteristics of service supply chains. Wang et al. (2018) summarize these as:

- intangibility – where the service itself is intangible although the output may be tangible;
- inseparability – services are simultaneously produced and consumed;
- perishability – services are often time sensitive as they cannot easily be stored and transported;
- customer participation – customers provide inputs to service creation and consume the outputs; and
- heterogeneity – services are tailored to meet the requirement of each customer.

Because of this, there is difficulty in evaluating quality (Wang et al., 2018). Further, there are two-way interactions between customers and service providers during service delivery (Li and Choi, 2009), and there is an emerging field of research exploring how service networks can meet the needs of a

customer (Sampson et al., 2015). Given the importance of such interactions, the management of relationships within service supply chains is important (Ellram et al., 2004). However, unlike many of the service applications studied in this research field, logistics represents a derived demand as products are only moved in response to requests from the shipper or customer.

Through the lens of social network theory, this paper aims to explore the structure of relationships within the maritime logistics network. By doing so, insights into issues such as power, knowledge sharing and innovation in the maritime sector can be understood. Based on previous studies of service supply networks (such as Harland, 1996 and Wang et al., 2018), we analyze the dyadic relationships between four main organizations within the network – cargo owner, freight forwarder, shipping carrier and port operator. Maritime service supply chains provide heterogeneous (tailored) services to different customers and the research explicitly identifies factors leading to this, building on previous work in the maritime field by, for example, Heaver (2006). To support this, evidence is drawn from 41 in-depth semi-structured interviews undertaken in the Taiwanese maritime logistics sector.

These insights advance service supply chain thinking in several ways. Much of the research in service supply chains focuses on business-to-consumer research, with less emphasis on business-to-business applications (Sampson et al., 2015). Further, Chaudhury et al. (2020) identify that logistics has received less attention than other service supply chains. Logistics services can bring added complexity through derived and even double-derived demand for services. There are relatively few studies using social network theory in service supply chain management, with this paper demonstrating how these service supply networks change due to different factors affecting relationship heterogeneity. There are also contributions to maritime logistics research, where the supply network perspective is uncommon and factors determining relationship heterogeneity require more detailed understanding.

The remainder of the paper is organized as follows. Section 2 reviews the literature in key areas. Section 3 describes the design of the research method for the study. Sections 4 and 5 present the findings from the research, and this is followed by section 6, a discussion of the findings. The conclusion, contributions, limitations and suggestions for future research directions are provided in section 7.

2. Literature review

The literature review firstly considers service supply chains generally, before looking at relationship management in maritime logistics and finally the previous work that considers heterogeneity within the sector.

2.1 Service supply chains and social network theory

Service supply chains have particularly risen to prominence over the past two decades, with a recognition that established frameworks within supply chain management for manufactured items were not always compatible with a service environment. Baltacioglu et al. (2007) provide a history of service supply chains, while Ellram et al. (2004) defines service supply chain management as “the management of information, processes, capacity, service performance and funds from the earliest supplier to the ultimate customer”. As already noted, there are several features that are considered common to service supply chains. These include intangibility, inseparability, perishability and customer participation (Wang et al., 2018, Hemilä and Vilko, 2015). However, this paper particularly focuses on heterogeneity, where services need to be tailored to specific customer requirements. The consensus within the literature is that the service supply chain requires this tailoring for different customer segments, although Arlbjørn et al. (2011) argues that there may be some services which are offered homogenously to many customers. Within logistics, work such as by Bask (2001) and König et al. (2019) have provided frameworks to understand this heterogeneity. In maritime logistics, Heaven (2006) indicates that the heterogeneity of a liner shipping logistics service reflects different types of businesses, processes and preferences.

In terms of the processes involved in service supply chain management, Boon-itt et al. (2017) build on the earlier model by Ellram et al. (2004) and propose seven different activities. Particularly important amongst these are customer relationship management and supplier relationship management. These activities develop long term relationships along the supply chain, and emphasize coordination, information sharing and feedback between supply chain actors (Boon-itt et al., 2017). Within this, however, it is important for firms to understand where, and with whom, they should foster strong, collaborative arrangements and when an arms-length relationship may be more appropriate (Barratt, 2004; Golicic and Mentzer, 2006). The later parts of this literature review consider these issues in a maritime logistics context.

Social network theory provides one means by which relationships can be explored, where a set of actors are the nodes while the ties represent the interactions between them (Laumann et al., 1978). These ties can be considered ‘strong’ or ‘weak’, based upon the similarity and frequency of interaction between the nodes (Granovetter, 1973). Structural holes exist where there are no direct connections between actors, although weak ties can bridge these networks (Rost, 2011). These weak ties are particularly valuable as they enable the flow of information, knowledge and value between networks (Burt, 1992). Such flows are often considered to be associated with social capital.

Social capital reflects the goodwill between actors in a network, from which the information and influence then lead to tangible effects (Adler and Kwon, 2002). If these links particularly cover structural holes, it may be possible for the firm to get new information to address business issues (Turban et al., 2012). In the context of supply chains, the effects from flows of social capital include loyalty, improved buyer performance (Villena et al., 2011), reduced opportunism (Hartmann and Herb, 2014), and improved resilience (Johnson et al., 2013). Handoko et al. (2018) suggest that social capital has a mixed impact on knowledge exchange, and depends upon factors such as integration and power between supply chain members.

There are two schools of thought in relation to actors who operate in the bridge position. One suggests that this role provides the actor with additional power in the network, while another perspective is that the bridge can act to build a larger network with more members (Li and Choi, 2009). Overall, the theory suggests that networks should have a mix of strong and weak ties (Rost, 2011). In the context of service supply chains, Li and Choi (2009) also demonstrate how relationship structures within networks evolve during different phases of outsourcing, with bridges decaying and potentially transferring to other actors. Barratt (2004) further identifies that there is a need to understand where, with whom, and how firms can collaborate within supply chains, and that these relationship structures change over time.

2.2 Relationship management in maritime logistics

Maritime logistics research is largely dominated by analyses of dyadic relationships between two of the major actors in the supply chain. Much of the work focuses on process-related activities between members of the maritime logistics network, such as the choice of service providers including ports (Tongzon, 2009), carriers (Maloni et al., 2016) and freight forwarders (Murphy and Poist, 2000). Vural et al. (2019) suggest that existing research involving multiple actors has focused on the individual perspectives of these actors rather than taking a relational approach. There is limited research explicitly discussing the relationships between the major actors in maritime logistics. Cargo owners are often more peripheral in maritime logistics research due to their distance from the transport-related actors (Lau et al., 2017), while port relationships tend to be considered solely with shipping lines (Ng, 2012) or freight forwarders (Tongzon, 2009). Relationships between ports and cargo owners appear limited (Olivier and Slack, 2006), and therefore a structural hole exists. The bridging role played by freight forwarders and shipping lines within the maritime network leads to a potential paradox in a situation with increased competitiveness, and at the same time a higher degree of collaboration.

On the one hand, this bridging role is only based upon weak links, with shipping lines and freight forwarders retaining power and control, and this creates competitiveness between members of the network (Woo et al. 2011). For example, Martin and Thomas (2001) indicate that the oversupply of terminal capacity discourages shipping lines from building strong relationships with ports and has led to a highly competitive environment for ports. Likewise, Maloni et al. (2016) state that commoditization among ocean container carriers limits the formation of long-term relationships with cargo owners. Shipping carriers can also use their power in a bridging role to bypass the freight forwarders by developing direct relationships with cargo owners in order to differentiate services and gain a competitive advantage through the provision of value-added services (McCalla et al., 2004; Frémont, 2009). In doing so, this also affects relationships between shipping carriers and freight forwarders. Frémont (2009) suggests that shipping carriers should continue to be careful to maintain good relations with freight forwarders despite moving into logistics services, for they cannot do so without the volumes of business forwarders provide.

Conversely, the bridging role leads to the development of larger collaborative networks with dyadic links becoming stronger over time. Bichou and Gray (2004) indicate that integration between shipping carriers and ports resulted in dedicated terminals fitting organizational requirements to achieve efficiencies and establish more effective operations. Further, Brooks (1993) suggests that cargo owner-shipping carrier partnerships are an attractive strategy for service differentiation of shipping carriers. Bichou and Gray (2004) also highlight the desire for ports to integrate with other members of the maritime network while Jang et al. (2013) show that container shipping carriers should develop a high-level of relationship quality with cargo owners in order to build loyalty.

In the context of relationship management at a network level, the main body of work around port communities recognizes the breadth of stakeholders that support the functioning of a port. Both Martin and Thomas (2001) and Carbone and De Martino (2003) focus on the connections between members of the port community, while Notteboom and Merckx (2006) considers the relationship dynamics that exist. While cooperation at the operational level between the actors in the supply chain may have increased, this has not necessarily resulted in increased commitment to a long-term future relationship with the ports. Demirbas et al. (2014) identifies that there are insufficient studies on the supply chain orientation of ports, exploring the role of ports within supply chains, and examining the interfaces between an organization that utilizes a port and a port authority/operator. These networks extend beyond the maritime network and show the value of bridging structural holes that often exist around ports.

2.3 Heterogeneity in service supply chain relationships

Given that service supply chains provide a heterogeneous output in response to varying customer requirements, relationships at different interfaces in these supply chains will vary. Not all relationships need be closely integrated and coordinated throughout the supply chain (Mason et al., 2007). There are a number of factors which could influence relationship strength among actors in the supply networks, including interpersonal relationships (Palmatier et al., 2006), loyalty between customers and service providers (Liljander and Strandvik, 1995), the strategic role and capability of the firms in the network (Tuli et al., 2010), the level of dependency (Moore et al., 2012), and the complexity of products/services (Bask, 2001). In order to offer heterogeneous services more effectively and efficiently for the customers, it is important for Logistics Service Providers (LSPs) to develop matching relationships with network actors (Bask, 2001).

Within maritime logistics, there is limited appreciation of the heterogeneous nature of these service supply chains, and the implications of this for relationships. Evangelista and Morvillo (2000) conclude that shipping lines respond to the needs of service differentiation through more or less broad levels of integration among actors, while Balci et al. (2018) suggests that customer service and customer relations can be effective differentiators for container lines. Based on Bask's (2001) contingent logistics research, Lagoudis et al. (2010) suggest the collaboration approaches between carrier, supplier and customer should vary depending upon the nature of service provision, yet their research lacks primary empirical support for this.

3. Research Method

According to the literature review, research into the relationships among the actors within the maritime logistics network and the factors which influence them remains underdeveloped, especially when looking beyond the dyad. Therefore, exploratory in-depth semi-structured interviews were conducted to gain insights into the factors affecting the relationships.

3.1 Interview protocol

The design of interview questions was guided by Harland (1996) and Lambert (2001). The former suggests aggregating information gathered on multiple dyadic relationships to give insight into network behaviour while the latter emphasizes collecting data on supply chain structure (actors and links between them), key business processes and management components (tangible product/service flows and intangible relationships between actors). Such an approach is well-recognized in maritime logistics research (e.g. Carbone and De Martino, 2003). In addition, Bask's (2001) notion of heterogeneous relationships were added as one of the measurements. Within the interview protocol

(see Appendix 1), the questions were developed to reflect the literature review as detailed previously. The interviews began with general, open questions, followed by more specific questions in order not to bias the respondents. Therefore, an in-depth understanding of the wider maritime logistics network was obtained from the information about the interactions from each of the 6 dyadic links between 4 main actors – cargo owner, freight forwarder, shipping carrier and port operator – as depicted in Figure 1.

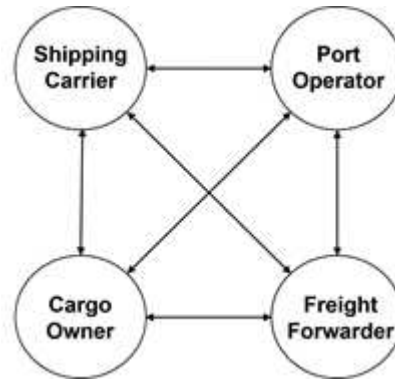


Figure 1 The framework of analysis for the maritime logistics network

Before running formal interviews, pilot interviews were conducted with two senior professionals in the Taiwanese shipping industry. The topics in the interview guide were revised in line with their suggestions, including the use of language that is comprehensible and relevant to the interviewees and avoiding terms that were more familiar to an academic audience.

3.2 Data collection

Purposive sampling was applied to sample participants in a strategic way, so that those sampled were relevant to the research questions (Bryman, 2012). Based on the purposive sampling approach, highly-experienced professionals familiar with the research topics were selected. Care was taken to ensure that the four main actors in the maritime network were represented, and that there was variety in the services offered by their organizations. Further, gaining access was an important issue, and creating a situation where the interviewees willingly offered time and were sufficiently motivated to answer the questions also needed consideration. The request for an interview was made by email and followed up by telephone call to the interviewee. The benefits of the research to the participants and their organization were emphasized, and issues of anonymity assured. Further, appointments were based on interviewees' availability.

The participants were mainly based in Taiwan, which has well-developed manufacturing and maritime sectors, and the majority of these participants' organizations were involved in global scale business.

According to WTO (2019), Taiwan ranked within the top 20 in world merchandise trade. With regards to the shipping industry (UNCTAD, 2019), Taiwan is ranked 9th for ownership in the world container-carrying fleet, with four liner shipping companies ranked within the top 20 globally and Kaohsiung Port being the 15th largest container port in terms of throughput.

The formal exploratory in-depth semi-structured interviews were conducted with 41 interviewees from 23 different organizations, supplemented by four site observations and the analysis of company documents. The participants included 17 professionals from leading shipping carriers, 8 from freight forwarders, 10 from port operators and 6 from cargo owners, from managerial to technical and operational levels, providing a wide range of perspectives in relation to industry practice (see Table 1). Interviews were either carried out face-to-face or by Skype.

Table 1 Background of the interviewees

Industry	Firm	Number of Interviewees	Working age range (years)	Average interview length (minutes)
Shipping Carrier	Global container shipping company (SC1)	9	10-40	150
	Global container shipping company (SC2)	5	15-35	120
	Global container shipping company (SC3)	1	15	100
	Global container shipping company (SC4)	1	7	80
	Global container shipping company (SC5)	1	5	60
Freight Forwarder	Freight Forwarder (FF1)	1	25	120
	Freight Forwarder (FF2)	1	19	120
	Freight Forwarder (FF3)	1	23	120
	Freight Forwarder (FF4)	3	7-25	150
	Freight Forwarder (FF5)	1	25	150
	Freight Forwarding Association (FF6)	1	25	100
Port Operator	Port Authority (PO1)	1	35	150
	Port Authority (PO2)	1	26	100
	Port Operator (PO3)	3	13-22	100
	Port Operator (PO4)	3	10-28	90
	Port Operator (PO5)	1	21	120
	Port Operator (PO6)	1	20	60
Cargo Owner	Cargo Owner's Association (CO1)	1	25	90
	Cargo Owner – Retail (CO2)	1	15	90
	Cargo Owner – Food (CO3)	1	15	90
	Cargo Owner – Homeware (CO4)	1	25	90
	Cargo Owner – ICT Products (CO5)	1	12	120
	Cargo Owner – Optronics (CO6)	1	5	70

Most of the participants were senior employees in their companies or organizations including company owners, chairmen, presidents as well as chief operators, and 67% of them have over 20-years work experience. Interviewees representing freight forwarding and cargo owner trade associations were also included. The site observations include the handling of a container ship in a port, a container yard of a port operator, and advanced warehouses which provide vendor-managed inventory, multi-

temperature storage and value-added services. Documents analysed included company reports and marketing materials.

3.3 Data analysis

One of the most common approaches to qualitative data analysis is thematic analysis (Bryman 2012). This is the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns. Therefore, interview data can be presented in relation to key themes (Smith, 1992). Counting the frequency of the occurrence of certain incidents, words, or phrases is one method to denote a theme (Bryman and Burgess, 1994). Further, Silverman (1985) argues that quantification of findings from qualitative research can often help to uncover the generality of the phenomena being described. Bryman (2012) suggests that qualitative researchers can inject greater precision into estimates of frequency through quasi-quantification using terms such as 'many', 'rarely', and 'some' as a reflection of the scale and depth of response.

The interviews were transcribed in detail from field notes and coded by analyzing the interactions between the aforementioned actors in the maritime logistics network. The results were inductively summarized and the selected quotes from interviewees are shown as the evidence (Wolcott, 1990; Easterby-Smith, 2012). Through the thematic analysis, causes of heterogeneity were noted. Some clustering of these codes led to the identification of 13 factors (see Table 3). While largely generated inductively, it is worth noting that the main researcher had previous longitudinal immersion (Wells and Nieuwenhuis, 2017) in the Taiwanese maritime logistics sector.

The strength of the relationships for the most frequently identified factors were presented based on the concept of quasi-quantification. Relationship strength level was classified in terms one of four rankings: 0 = no relationship, + = loose relationship, ++ = medium relationship and +++ = close relationship. This classification was made by the main researcher, based upon the thematic analysis of the interviews and reviewed by the research team. The medium relationship (++) was the reference point, and the different classification depended on the variation of relationship strength. As each additional factor was added, the relationship strengths were classified in comparison with the previous factors. Eventually, a table was developed (Table 4), summarizing how different relationship structures were influenced by various attributes.

3.4 Research quality

Different dimensions of trustworthiness can be applied to assess the rigor of qualitative research. This research follows the approaches suggested by other researchers to research quality, with the steps taken summarized in Table 2.

Table 2 Research Quality in the Data Collection Process

Criteria	Method of addressing
<p><i>Pre-understanding</i></p> <p>Extent to which the researchers are familiar with the empirical phenomenon</p> <p>(Guest et al., 2012; Annala et al., 2019)</p>	<p>All of the research team members were experts in transport, logistics and supply chain management. The main researcher had 10 years working experience with the maritime logistics industry in Taiwan, and dealing with national-level projects for developing the maritime industry.</p> <p>Four research team meetings were conducted and the relevant literature was reviewed before running the interviews.</p> <p>Pilot interviews were conducted with two senior professionals in the shipping industry. The interview protocol was revised in line with their suggestions.</p>
<p><i>Credibility</i> (internal validity and authenticity)</p> <p>Extent to which the results appear to be an acceptable representation of the data</p> <p>(Lincoln and Guba, 1985; Guest et al., 2012; Annala et al., 2019)</p>	<p>There was a continuous process of reflecting interview findings with other interviewees in different positions or different companies/organizations, to ensure the correct understanding.</p> <p>The data collection and initial assessment were managed by the main researcher and discussed in review meetings with the research team.</p> <p>Data were collected via multiple sources including in-depth semi-structured interviews, site observations and additional document analysis to validate findings.</p> <p>Verbatim quotes were used to increase the validity of findings by directly connecting the researcher's interpretations with what participants actually said.</p>

<p>Transferability (external validity and fittingness)</p> <p>Extent to which the findings can be applied to other contexts</p> <p>(Lincoln and Guba, 1985; Guest et al., 2012; Annala et al., 2019)</p>	<p>Purposive sampling was applied to sample participants in a strategic way. The participants included professionals from across actors in the maritime logistics network, and from managerial, technical and operational levels. The background information about the informants, the research setting, and limitations were noted in the paper to allow others to assess transferability.</p>
<p>Dependability (reliability and auditability)</p> <p>Extent to which there is consistency of explanations</p> <p>(Lincoln and Guba, 1985; Guest et al., 2012; Annala et al., 2019)</p>	<p>The interviews were conducted and the transcripts coded by the same researcher in order to achieve consistency in explanations. The summarized data were reviewed by the interviewees to see if they accurately reflected their intent and meaning.</p> <p>The data collection and initial assessment were managed by the main researcher and discussed in review meetings with the research team.</p>
<p>Utilization (applicability, action orientation)</p> <p>Extent to which the findings are relevant for and can be used to benefit the participants</p> <p>(Lincoln and Guba, 1985; Annala et al., 2019)</p>	<p>The results were shared and discussed with professionals in several training courses and workshops after the completion of the study.</p>

4. Structure of the business relationships between major actors

The following sections detail the findings from the interviews when the participants were asked to comment on the nature of the business relationships between the major actors in the maritime logistics networks. This starts from general business relationships in the networks before considering each dyadic link. More details on the coding, including exemplar quotes, are included in Appendix 2.

4.1 General business relationship within maritime logistics networks

When considering the overall network, two contradictory perspectives emerged, similar to that outlined earlier in the literature review. A small group of four interviewees expressed that no partnership exists among these actors in the networks: *“There is no partnership except for a business relationship which is a seller and buyer relationship between these players in business practice.”* [FF4]. Their relationships depend on price competitiveness, different needs, different degrees of co-operation based on business benefits, and their previous experience of working together. Further, it was noted that *“Each player in this network is usually only familiar with and cares about the immediate and important trading partner for themselves. Therefore, they usually don’t have direct understanding*

of the triadic business relationship." [SC1]. From this perspective, the network is made up of predominantly weak links, with the potential for structural holes to exist between members of the network. The network is also dynamic due to interdependencies in the relationships between members – as relationships between cargo owners and shipping carriers emerge and fade, so the choice of port also changes [SC2].

Secondly, partnerships were mentioned as a trend evolving from arm-length business relationships by four interviewees. Whether the actors could have long-term business relationships or partnerships depends on consistent mutual dependency, organizational compatibility and common goals to develop together in their business. This is akin to the presence of social capital within the network, building loyalty between network members and leading to structural holes being filled. For example, two respondents noted *"If port operators offer more integrated service, they will weaken the ties between the agents [shipping carriers and freight forwarders] and cargo owners"* [PO3]; and *"Port operators have started to serve customers' customers who are the cargo owners."* [FF5]. There is also potential for the network to grow further, with SC3 noting that freight forwarders and shipping carriers are building links with the cargo owners' customers.

A further three interviewees recognised that, in their circumstances, a compromise position existed whereby they were involved in networks that included both cooperation and competition: *"In summary, business relationships between players at the horizontal and vertical levels are mixed with co-operation and competition, and looking to achieve a balance point in the dynamic environment."* [SC1].

4.2 Shipping carriers-port operators

Although not the most frequent observation, the reliance between a shipping carrier and port appears to underpin their relationship. According to five interviews, shipping carriers are the most important customers of port operators: *"Even though all the maritime logistics service providers have cooperative relationships with ports, shipping carriers have more influence on the ports compared with other players."* [FF3]. Therefore, port operators traditionally focus on the needs for these major customers, through operational level relationships that emphasize efficiency and effectiveness. Social network theory suggests that improving efficiency relies on the social capital within the network, and it is common to see more strategic relationships between these network members, such as through dedicated terminals. Four interviewees also mentioned other types of strategic relationship between these two network members, for example, PO1 identified a number of activities including *"...renting dedicated container terminals; forming a joint venture to run the feeder services; joint projects for*

overseas investment.” However, because shipping carriers often perform a bridging role with ports, they are able to exploit the power that this delivers and can lack loyalty, with port choice dependent upon the cargo being moved.

4.3 Cargo owners-shipping carriers

The customer base for shipping carriers was identified as cargo owners and freight forwarders. In terms of the interaction between the cargo owners and shipping carriers, the big accounts can exercise their power and tend to negotiate with several shipping carriers: *“...some large cargo owners are doing trial order purchasing from different shipping carriers to pursue the lowest cost which means they are actually squeezing the benefits from us.”* [SC2]. These benefits include delayed payment, assigning of shipping destinations, extending container use time and setting up dedicated Electronic Data Interchange (EDI). The shipping carriers tolerate such big accounts, because they can obtain the basic volume of cargo from them and secure a high loading factor. Therefore, it appears that, although shipping carriers can gain power through being a bridge in the maritime network, this can be tempered by the frequency of interactions (volume of goods being a proxy for this) with cargo owners building social capital. In contrast, the smaller cargo owners have less power to negotiate the shipping freight and need to follow the shipping carriers’ rules, even though they may contribute higher profit margins for the shipping carriers: *“The majority of cargo owners are smaller and medium sized companies, and they have loose relationships with shipping carriers as well as less power to negotiate, and need to follow the shipping carriers’ rules, such as the cost of terminal handling charge.”* [CO1].

4.4 Cargo owners-freight forwarders

Sixteen interviewees made comments relating to the size of the cargo owner when considering their relationships with freight forwarders. While large cargo owners are adept at splitting their transport requirements between freight forwarders and shipping carriers, small and medium cargo owners tend to work solely with freight forwarders in order to obtain a better price and service: *“Small and medium cargo owners need the better and complete service from freight forwarders, and some of them do not care about being charged a little higher in price.”* [FF1]. When used, freight forwarders can act as a bridge between cargo owners and shipping carriers. However, over time the structural hole that they bridge can be closed, as observed by two interviewees, including FF5: *“Some cargo owners would buy a freight forwarders’ service initially, and then contract directly with shipping carriers to pursue the lower cost when they are more familiar with the maritime logistics system.”* This again suggests that weak links, and the flows of social capital that they enable, can play an important role in addressing structural holes within the maritime logistics network by bringing wider network members more closely together.

4.5 Shipping carriers-freight forwarders

The relationship between freight forwarders and shipping carriers is complicated, partially because both can act as a bridge around the structural hole between cargo owners and port operators. Consequently, shipping carriers' policies for working with freight forwarders are varied. Some shipping carriers rely more on freight forwarders, while the others prefer to pursue the cargo directly with cargo owners. In new or specialist markets, shipping carriers need to rely on and cooperate with the freight forwarders who have connections and are more capable of gaining cargo there, showing the value of weak links to new networks: *"In special cases, shipping carriers and freight forwarders may have opportunities to work together, for example, they could make a team to attend a bidding for a project cargo."* [SC1]. According to the interviewees, Taiwanese shipping carriers are generally more powerful than the freight forwarders. Freight forwarders do not have their own fleets and rely heavily on these shipping carriers' assets. As with the relationship between shipping carriers and cargo owners, some freight forwarders have a close business relationship with connected EDI systems, preferential shipping rates and guaranteed slots: *"Shipping carriers look for cargo by themselves, and also from freight forwarders. There is a special business relationship between them."* [SC1]. This reflects the volume of trade they offer and, as noted earlier, shows how interactions can moderate power relationships in the network.

4.6 Cargo owners-port operators

Fifteen interviewees indicated that there is no direct business relationship existing between the cargo owner and the port operator, representing a significant structural hole. As FF3 commented, *"Compared to shipping carriers and freight forwarders, cargo owners even cannot feel the existence of the port."* The choice of port is often determined by either the shipping carrier or freight forwarder and therefore, according to the interviewees, the immediate business relationships would only exist between cargo owners and port operators in a few specific situations. These include the ports' proximity to the cargo owner, serious inefficiency, frequent cargo damage occurring in the same port, or unacceptable port charges: *"There is more interaction between Taichung Port and the cargo owners within Taichung Industry District, as they are very geographically close to each other."* [FF4]. The customs system may influence a cargo owners' decision to choose the port, which was mentioned by two interviewees. Facing intense competition, some port operators are starting to take the initiative of offering more benefits for cargo owners. Such benefits include offering preferential rates to use the warehouses in the port area and providing value-added functions which are beyond the conventional load/unload functions to deal with extended business: *"By [developing value adding activities], ports can approach the cargo owners and help them to load/unload their cargo remotely and provide more logistics functions."* [CO1]. Some large cargo owners are also trying to take advantage of these

opportunities. This shows how weak ties can emerge to fill structural holes, and how these weak links can enable knowledge and innovation to spread within the network, in this case enabling cargo owners to take advantage of the value-added services from ports.

4.7 Freight forwarders-port operators

Similar to the business relationship between cargo owners and port operators stated above, relationships between freight forwarders and port operators also tend to be less close: *"We have loose business relationships with freight forwarders and don't take them as our main customers."* [PO3]. Freight forwarders are more concerned on the choice of shipping lines as they may affect the cost and service quality, for example transit time and efficiency. There are few situations where freight forwarders and port operators interact, such as when port operators provide spaces for freight forwarders to operate value-added services: *"Taiwan International Port Corporation is starting to look for partners from freight forwarders to deal with the multi-country cargo consolidation business."* [SC1]. The emergence of these value-added services is one source of innovation within the maritime network and builds upon the weak ties that exist.

5. Relationship heterogeneity in the maritime logistics network

As noted earlier, a key feature of service supply chains is heterogeneity in the output provided to customers, and previous literature in the logistics domain suggests that this should extend to relationship management (Barratt 2004, Bask 2001). Through the interviews (summarized in Table 3), a wide range of factors that resulted in heterogeneity emerged, with five being particularly significant, namely: service complexity; cargo type; cargo owner type; port role; and trade route.

Table 3 Coding of the factors that impact the heterogeneous relationship strength

Factor impacting heterogeneity	Number of interviewees who identified this factor				
	Shipping Carrier	Freight Forwarder	Port Operator	Cargo Owner	Total
Service Complexity	4	6	4	5	19
Cargo Type	4	6	2	4	16
Cargo Owner Type	3	3	3	6	15
Port Role	2	2	6	0	10
Trade Route	3	2	2	1	8
Market Structure	2	5	0	1	8
Dependency	1	3	2	0	6
Market power	3	0	1	1	5
Market adjacency	2	1	1	0	4
Personal relationships	1	1	0	0	2
Information sharing	0	2	0	0	2
Culture	1	0	0	0	1
Traditional practice	0	1	0	0	1

Using the quasi-quantification approach detailed in the method, the different existing relationship strengths for each factor are summarized in Table 4.

Table 4 Relationship structures between major actors in maritime logistics network

Factors impacting heterogeneous relationships Relationship Link	Service Complexity			Cargo Type		Cargo Owner Type		Port Role				Trade Route		
	Routine	Standard	Customized	FCL	LCL	Manu- facturer	Brander/ Retailer	Non Value- added	Value- added	Transship- ment	Import/ Export	Taiwan to North America	Taiwan to Europe	Taiwan to Asia
Cargo Owner – Freight Forwarder	+	++	+++	++	+++	++	+++	+	++	+	+	+	+++	+++
Cargo Owner – Shipping Carrier	+	++	+++	++	0	+	++	+	+	+	+	+++	++	++
Cargo Owner – Port Operator	0	0	+	0	0	0	+	0	++	0	++	+	++	++
Freight Forwarder – Shipping Carrier	+	++	+++	++	+++	++	+	+	+	+	+	+	+	+
Freight Forwarder – Port Operator	0	0	+	0	++	0	0	0	+++	+	++	0	+	+
Shipping Carrier – Port Operator	+	++	++	++	++	++	++	+	++	+++	++	+++	++	++

0 = No relationship; + = Loose relationship; ++ = Medium relationship; +++ = Close relationship

5.1 Service complexity

Bask (2001) describes three types of logistics service (routine, standard and customized) and, through the interviews, it was possible to align these to different types of container service. These differences were best summarized by one respondent from SC1: *“If you deliberately ask me to distinguish our services, I would say that it could depend on the operational differences from different types of container. These services include: general cargo, reefer cargo and open top cargo.”* Routine services are general, dry container services which do not require any specific arrangements in transport. Special container types require limited tailoring of the service provided, and therefore can be considered as a standard. For example, reefer container service for temperature-sensitive cargoes (e.g. fruit) may need temperature setting, controlling or monitoring: *“Reefer cargo... needs more tracing and care taken with it.”* [SC1]. Out-of-gauge/project cargo services are the most complicated and highly customized services and interviews with SC1, SC3, FF4 and FF5 defined these as the transportation of large, heavy, high value, critical pieces of equipment (e.g. yachts, helicopters or exhibiting antiquities).

The findings verify that as services become more complex and customized, the closer the relationship should be between the freight forwarders, shipping carriers and cargo owners. These services require special knowledge, facilities and marketing channels, which can be gained through more connections within the maritime network and the ability to draw on the benefits from social capital flows along both strong and weak links. Considering individual dyads, an increasing level of complexity or customization increases the possibility for customers to influence the output and flexibility of services, and calls for more joint work between the freight forwarders, shipping carriers and cargo owners from planning to operations. However, the service differentiation provided by ports mainly aims to satisfy the needs of shipping carriers: *“For shipping carriers, their service differentiation depends upon different kinds of [cargo]; for port operators, their service differentiation mainly depends upon the level of customized service for shipping carriers.”* [SC1]. This suggests that, even with some weak links between ports and other members of the maritime network, the freight forwarders and/or shipping carriers retain a central position within the network.

5.2 Cargo type

A key distinction in relationship heterogeneity identified by interviewees is between full container load (FCL) and less-than-container load (LCL) consignments. As their titles suggest, these distinguish between whether a cargo owner can fill a container or not. In both of these instances, interviewees suggested that connections to ports represent a structural hole, with shipping carriers generally taking a bridging role. However, the findings indicate that in both situations, other structural holes exist, between cargo owners and shipping carriers for LCL, and between freight forwarders and ports for

FCL. These occur because shipping carriers are not interested in LCL shipments while FCL shipments do not require repacking at the port: *“As a shipping carrier, we ... are more interested in dealing with the FCL cargo. On the other hand, the freight forwarders are more capable of dealing with the LCL cargo.”* [SC2]. *“For the LCL cargo, freight forwarders seldom face threats from shipping carriers as shipping carriers are not interested in dealing with this uneconomical business.”* [FF3].

5.3 Cargo owner type

It was found that different types of cargo owners have different logistics outsourcing strategies, meaning they have different business relationships with different types of maritime logistics service providers: *“The business relationship between cargo owners and maritime logistics service providers depends on the industry, region and market needs”* [CO5]. Branders and large retailers usually dominate the logistics process, as logistics is the core part of their value chain: *“As a leading retailer, logistics is the core part of our value chain. ... Therefore, we tend to be an integrator and control the logistics by ourselves or our subsidiaries.”* [CO2]. By taking on this role, the bridging power of freight forwarders can be reduced. Consequently, the strongest links are with the shipping companies: *“As a retailer who needs to move more than 10 thousand TEUs [Twenty-foot Equivalent Units] per year, normally the orders are made in FCL basis and for that matter, we speak directly with vessel companies.”* [CO4]. However, they will also retain weak links with freight forwarders to provide access to capacity if required as well as handling LCL shipments.

By contrast, manufacturers tend to outsource their logistics provision to specialists, either freight forwarders or the shipping carriers: *“As a leading electric manufacturing service provider, we tend to outsource our whole logistics business to professional logistics providers. However, we seldom rely on single service provider but usually with several spare providers in order to exercise the bargain power if needed.”* [CO5]. This latter point is particularly important as it means manufacturers have a network of weak links, which enables them to balance the power freight forwarders or shipping carriers could exert if bridging a structural hole.

5.4 Port role

Twenty participants mentioned that port operators usually have no direct relationships with cargo owners and freight forwarders, but if port operators could provide value-added services directly or the space to operate these activities for cargoes (for example, a distribution centre or free trade zone), they may have more opportunities to establish direct relationships. *“The newly established Taiwan International Port Corporation started to run the warehouse business to meet cargo owners’ needs. Launching the Free Trade Zone scheme is also attractive for cargo owners”* [FF5]. As social network

theory suggests, introducing weak ties into the maritime network will enable the diffusion of knowledge and lead to the opportunity for innovation through value adding services. This could reflect the suggestion of six interviewees that landlord ports, where port authorities lease the infrastructure to private companies while retaining ownership, have more opportunities than public ports to establish relationships with other actors.

Five interviewees suggested that relationship structures can also be influenced by whether the ports mainly operate transshipment or import/export cargoes. Only shipping carriers decide which transshipment ports they call at, while import/export ports are usually decided by cargo owners: *“There are several ‘hot’ ports in the world... The common point of these ports is they are all important import or export ports, and geographically close to the manufacturers or market. In contrast, transshipment ports are not necessarily close to the cargo owners, and can be chosen by the shipping carriers at their convenience to manage the shipping operations.”* [PO1]. Therefore, transshipment ports have closer relationships with shipping carriers, and import/export ports keep closer relationships with cargo owners. In the latter case, such links may eliminate the bridging role of the shipping carrier and, in doing so, reduce their power over port choice: *“Port of Antwerp encourages local cargo owners to apply the FOB [Free On Board] trade term to indirectly make shipping carriers call at this port”* [SC1].

5.5 Trade route

The functions of freight forwarders and shipping carriers vary between markets when considering cargo moving from Taiwan. For traffic from Taiwan to North America, shipping carriers usually need to provide both shipping and inland rail or truck services to cargo owners' depots. By contrast, for Europe-bound cargo, they only need to provide shipping services, as inland transport is mainly managed by freight forwarders: *“... the proportion of direct cargo owner contracts in the US is higher than 50%. On the other hand, it is less than 20% in Europe.”* [SC1]. This difference may be due to the knowledge that freight forwarders bring in dealing with a more complex marketplace: *“Freight forwarders will play more important roles in the maritime logistics chain in Europe, as the different systems between these multiple countries and customs systems are more complicated in this area.”* [FF7]. In terms of freight to Asia, freight forwarders again play a more significant role, and the shorter sailing times mean frequency of communication becomes important: *“The tempo of the intra-Asia shipping route is quite quick compared with the long-distance shipping route; you should be very flexible and need to respond quickly enough. The role of freight forwarders in this region is similar to Europe.”* [SC3]. As a consequence of this, the network for North American traffic from Taiwan is oriented around close links

between the shipping carrier and both cargo owner and port operator only, while the other markets see a greater network density with a larger set of close connections between network members.

In summary, Table 4 shows that different factors impact relationship heterogeneity in the maritime logistics network, and it is suggested that different actors have varying interactions according to different situations. Each link within the maritime logistics network is not necessarily at the same level of integration, leading to different structures of strong and weak links. Looking at specific dyads, cargo owner – freight forwarder, cargo owner – shipping carrier, freight forwarder – shipping carrier and shipping carrier – port operator generally have strong links. By contrast, port operators' connections with cargo owners and freight forwarders are the weakest links in the maritime logistics network, often not existing and leading to structural holes.

6. Discussion

The results of this research provide a more detailed insight into the structure of relationships within the maritime logistics network. As Harland (1996) points out, aggregating information gathered on dyadic relationships gives an insight into network behaviour. Therefore, the information about the interactions from each of the six dyadic links between four main actors in this paper can contribute to an in-depth understanding of the wider maritime logistics network.

The strongest relationships exist between freight forwarders, cargo owners and shipping carriers, and reflect the contractual relationships between them. As such, this is not dissimilar from other findings in logistics service supply chains (Mason et al., 2007). The interview findings show that port operators are very dependent on shipping carriers as their dominant customers and are isolated from cargo owners and freight forwarders. This leads to a marginalized position in the maritime logistics network for ports, and the impact on social capital flows increases opportunism by other network members. This reflects the nature of double-derived demand for port services (Marlow and Paixao-Casaca's, 2003), and the port's role as a mere 'pawn in the game' of intermodal networks (Olivier and Slack, 2006). While this situation has previously been identified when considering solely dyadic relationships (Notteboom and Merckx, 2006), viewing the network more holistically through the lens of social network theory gives more detailed insights.

A consequence of these structural holes is that the shipping carrier performs a bridging role and therefore has greater power relative to the port operator. In exploiting this power, shipping carriers remain footloose with the port operators and do not get involved with long-term relationships. Many interviewees emphasized that the priority of shipping carriers is cargo, and then they choose the port

which offers the best incentives from the accessible alternatives. Further, the bargaining power of shipping carriers has dramatically increased due to the creation of the hub and feeder ports hierarchical system following concentration between shipping carriers (Ng, 2012).

While port operators and port authorities need relationships with shipping carriers, they should consider new relationships with other actors in the maritime logistics network to develop their businesses further. As Handoko et al. (2018) note, integration and power can influence the flow of knowledge through social capital within a network and so, by increasing the network density, ports can get the necessary insight to develop innovative value-adding services. This echoes the emerging suggestions (Woo et al., 2011; Ng, 2012) which urges ports to provide more logistics and value-added services in order to increase competitiveness and attract more cargo from cargo owners in the changing environment. From the interviews, there is evidence that complex services tend to have denser networks. However, there are also risks with this approach. The collapse of Hanjin Shipping put 11,000 jobs at the Port of Busan at risk, as a result of the shipping line previously accounting for 50% of the throughput (Park, 2016).

The heterogeneity of maritime logistics networks also impacts relationship structures. Five distinct factors impacting relationship structures were identified in this study, extending knowledge within the existing maritime logistics literature. The role and capabilities of firms is particularly important in terms of the trade route and whether a port is value adding or non-value adding. In terms of the social network view, the presence of additional, often weak links within a network enable the sharing of knowledge linked to a firm's capabilities. As an example, ports with more value-added functions will have more relationships within the maritime logistics network. Although suggested by research in the maritime logistics domain previously (Notteboom and Winkelmans, 2001; Weston and Robinson, 2008), this paper provides empirical support for the view that growing strong and weak links within the network will affect power and integration within the network, enabling the emerging value from knowledge to be captured by the service supply chain members.

There is also evidence of dependency by ports within the maritime network, something that has not been clearly identified previously in the literature (Woo et al., 2011; Ng, 2012). The dependency results from the power the shipping carrier obtains by bridging structural holes between the port and network members. This dependence is reduced when ports handle products where connections to, for example, cargo owners are needed as there is the opportunity to build additional links to increase network density and eliminate the structural holes.

While the relationships do strengthen as service complexity increases, which is consistent with Bask (2001), this is only true for the main relationships that are typically underpinned by contractual relationships. The port operator remains detached from the cargo owner and freight forwarder for all but the more complex services, leading to the continued presence of structural holes.

Although the above discussion focuses specifically on the maritime logistics context, this research also provides insights for service supply chains. Unlike many services, logistics is a derived demand and it has been suggested that, because of this, these service supply chains intersect between members of the physical supply chain (Sampson and Spring, 2012). The reality is that this situation is more complex, as the members of the physical supply chain will tend to interact most with an integrator – either the shipping carrier or freight forwarder in the context of this research. This then leads to double derived demand for providers of the resources to enable the logistics services (such as ports). Therefore, the importance of looking at service supply chain networks should not be underestimated as this provides a clearer picture of the network behaviour. The evidence from this research particularly illustrates how power and reliance exists between different members, often driven by structural holes.

Looking at service supply chains through a social network theory lens provides the opportunity to recognize where structural holes may exist, as well as examining how network density, power and dependency change in different situations. This research has demonstrated how the network's structure can influence an organization's power within the network as well as how social capital can enable knowledge and innovation to be used in providing services to different customer groups. Service supply chains face increasing challenges due to factors such as digitalization and sustainability (Ivanov et al., 2018) and meeting these challenges will likely need the closing of structural holes and the creation of weak and strong links between network members. For example, should blockchain technology become widespread in the maritime sector, there will need to be significant coordination and collaboration between organizations to enable, for example, data sharing (Valee, 2017).

7. Conclusion

A particular feature of service supply chains is their heterogeneity, and this can lead to nuances in the strength of relationships within the maritime logistics network. While this has been explored in more general supply chain (both for goods and services) and logistics studies, there is little research in the context and practice of international maritime logistics. The research identified that strong links tended to occur where contracts existed between the actors. A consequence of this is that the port operator is isolated from the other members of the service supply chain and therefore has to contend with structural holes which result in imbalances of power with other network members. While this

reflects the double derived nature of port demand, there are opportunities that can be achieved from developing weak links within the wider maritime network, increasing network density.

Further, this paper has identified a range of factors which fundamentally influence the relationship strength of main actors in maritime logistics networks. Stronger relationships tend to exist where complex services are required, either explicitly or through the need to provide added value services or handle less-than-container load shipments. Such service provision requires additional knowledge and innovation, which are facilitated by weak links and the sharing of social capital.

The research advances service supply chain thinking by demonstrating the importance of supply chain networks when considering services experiencing derived demand. Through using social network theory, the presence of both strong and weak links is connected to the heterogeneity in service supply chains, with a greater number of links potentially supporting more complex services. More generally, the work can contribute to addressing the lack of business-to-business and, within that domain, logistics applications in service supply chain research as identified by Chaudhury et al. (2020). In the context of maritime logistics, there has been a lack of understanding as to causes of heterogeneity in service provision and this paper contributes a deeper understanding of this. In terms of managerial implications, the findings can help practitioners correctly recognize their organizations' position in the maritime network and understand factors that may affect the relationship structure with other actors. Further, by understanding the roles of strong and weak links, firms can find the potential markets, work out new business models, and develop effective strategies for working with other actors in the network.

There are also some limitations that should be acknowledged. This paper specifically focuses on the context of Taiwanese containerized ocean transport and logistics. Other types of ocean transport and logistics, for example, bulk products or the tramp trade (where vessels are chartered for a specific voyage) may develop very different relationship structures in the network and are worth exploring further. In addition, the findings from this research were based on the shipping markets that Taiwan-based firms are more familiar with. Some other major markets, such as the Trans-Atlantic shipping trade route, have not been investigated. Further, the Taiwanese industry is characterized by state ownership of some port operators while, within the culture, interpersonal connections between individuals (*guanxi*) can have an impact on business relationships. Therefore, the networks developed based on different cultures may have varied relationship structures.

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Appendix 1: Interview Questions

Part 1 Interviewee information

1. Which role does your company/organization play in the maritime logistics network (e.g. cargo owner (shipper), shipping carrier, freight forwarder and port operator)?
2. What kind(s) of cargo (or product) are you dealing with (e.g. containerised general cargo, refrigerated cargo, automotive cargo)?
3. What are your company's major service or trade areas or lines?
4. What is your position within your company or organization? (Which department are you working for?)
5. How long have you been working in this company/organization and industry?
6. How many employees/members in your company/organization?

Part 2 Relationships between main actors in maritime logistics networks

1. Which actors do you think are the main actors who should be included in the maritime logistics networks?
2. Generally, at this moment, what relationships do you think exist between these main actors (e.g. integrated level from loose to close; from independent, an arms' length short-term operational relationship, partnerships, long-term collaborative, cooperative relationship, sharing ownership, establishing subsidiary; from operational, tactic to strategic integration; what kind of ICT is using, what information is sharing; what kind of bid and contract, how many suppliers and buyers)?
3. Ideally, what extent or level of these relationships do you think should be kept?
4. What reasons do you think will influence such relationships (e.g. customer's needs, different cargos (products), different types (e.g. complexity) of service, different trade terms, market structure, market power, organization's self-interest (e.g. keeping flexibility, cost consideration), and so on)? What barriers do you think will influence such relationships?

Part 3 Matching relationships between major players

1. In your opinion, what are the matching (more effective and efficient) relationships between the main actors respectively for different complexity of service provisions and relationship-inferential factors? Do you agree that all relationships need not be closely integrated and coordinated throughout the maritime logistics networks?

2. Could you identify different kinds of service provisions, namely: routine service, standard service and customised service which your company/organization provides or receive by different needs according to above concept?
3. Do you agree that the maritime logistics service for containerised general cargo, refrigerated cargo and project cargo can properly reflect the three different levels of complexity of service provisions respectively?

Part 4 Further comments

Are there any other comments you would like to make for this research?

Note: As most of the participants were based in Taiwan and English is not their primary language, the interviews were generally conducted in Chinese to overcome any language barriers and facilitate communication.

Appendix 2: Coding of relationships among main actors in maritime logistics network

Thematic area	No. of interviewees	Exemplar quote(s) not included in text
Overall network		
Lack of partnerships	4	<p>"I think partnership between the major players actually becomes rarer and rarer at the moment." FF2</p> <p>"There is no customer loyalty, but only acceptable prices to customers. Only when we offer a competitive price and service, can we build the dependency of our customers." FF4</p>
Emerging partnerships	4	<p>"Recently we started to work closely with a new single truck carrier which...charges more money, but they are more reliable and trustworthy than previous multiple carriers we used as they have never caused any cargo damage." FF1</p> <p>"We got 80% repeated orders, and we benefited from these orders with less risks. Such regular cargo does not necessarily contribute great financing revenues per unit, but its stability is very essential for shipping carriers." SC2</p>
Cooperation and competition	3	"For example, members in strategic alliances cooperate at the operation level, but become independent at the business level." SC1
Shipping Carriers – Port Operators		
Operational-level relationships	9	"Shipping carriers ask for low cost, efficient and convenience from port operators" PO1
Reliance	5	"Port operators are not like normal suppliers for shipping carriers. We cannot be too dominant with them as they usually include the public sector. If we don't deal with them well, we may lose the chance to run our business in those ports or even the countries they are located." SC1
Strategic-level relationships	4	"From port operators' perspective, we have several levels of relationships with the shipping carriers from arm-length to closely integrated..." PO1
Lack of loyalty	4	"The reason that shipping carriers call at the ports is quite simple. As a shipping carrier, we only follow the cargo. In the same area, we pick the port which offers the best deal including the low cost and attractive package." SC2
Cargo owners – Shipping Carriers		
Cargo owner size	7	"We only earn a small profit from the big accounts...but we need them to offer the base cargoes." SC1
Partnerships	5	"Cargo owners should maintain special relationships with the shipping carriers in order to obtain the enough space in peak season to complete the shipping tasks." CO1
Cargo owners – Freight forwarders		
Large size cargo owner behaviour	12	"The big accounts very often try to squeeze the Maritime Logistics Service Providers [freight forwarders and shipping carriers], instead of keeping the long-term business relationship with them. For example, one cargo owner usually invites 5 shipping carriers and freight forwarders to deal with their international logistics in order to gain lower costs." FF2

Small and medium size cargo owner behaviour	4	"As being a medium cargo owner, we usually use freight forwarders to deal with our cargo." CO6
Evolution over time	2	"For keeping a long-term business relationship with cargo owners, [freight forwarders] should strengthen themselves to reduce the risk of cargo owners switching to other service providers." FF4
Shipping Carriers – Freight forwarders		
Partnerships	7	<p>"In new markets, some shipping carriers rely on freight forwarders to connect with the local cargo owners and port operators." FF4</p> <p>"For some special cargo or complicated supply chains there will be joint efforts by carrier and freight forwarders, but it's not commonly seen, only for a handful of customers." SC2</p>
Complementary services	6	<p>"Freight forwarders often pick up the small business that shipping carriers are not willing to do." SC1</p> <p>"We mainly deal with door-to-door service for FCL [full container load] cargo. We don't deal with LCL [less-than-container load] cargo which is more doing consolidation, and we leave it to freight forwarders." SC5</p>
Co-opetition relationships	6	"Shipping carriers get cargo from freight forwarders, and then try to grab this cargo by directly contacting the cargo owners and skipping the freight forwarders. Shipping carriers should be very careful when dealing with this situation; they should consider whether it is worth losing their freight forwarder partners." SC1
Cargo owners – Port Operators		
No direct business relationship	15	<p>"We do not care about the operation details in the port sector, our strategy is to manage the freight forwarders and shipping carriers well, and make them deal with these minor operational issues." CO2</p> <p>"According to our own experience, port operators are starting to have closer relationships with large cargo owners nowadays. There are two big accounts coming to us to look for more cooperation." PO3</p>
Emergent closer relationships	10	"Port operators have started to serve customers' customers who are the cargo owners. The newly established Taiwan International Port Corporation started to run a warehouse business to meet cargo owners' needs. Launching the free trade zone scheme is also attractive for cargo owners" FF5
Freight forwarders – Port Operators		
Emergent closer relationships	9	"If cargo owners ask freight forwarders to deal with the inland transport and custom cleaning, the freight forwarders will be involved in choosing the ports. For example, if an importer asks

		shipment to Manchester, then the freight forwarder could engage in port choice." SC1
No direct business relationships	5	"In business practice, freight forwarders seldom get involved in the port choice, but get involved more in the shipping carrier choice. I feel that most of the port operators do not take freight forwarders as their customers." SC1